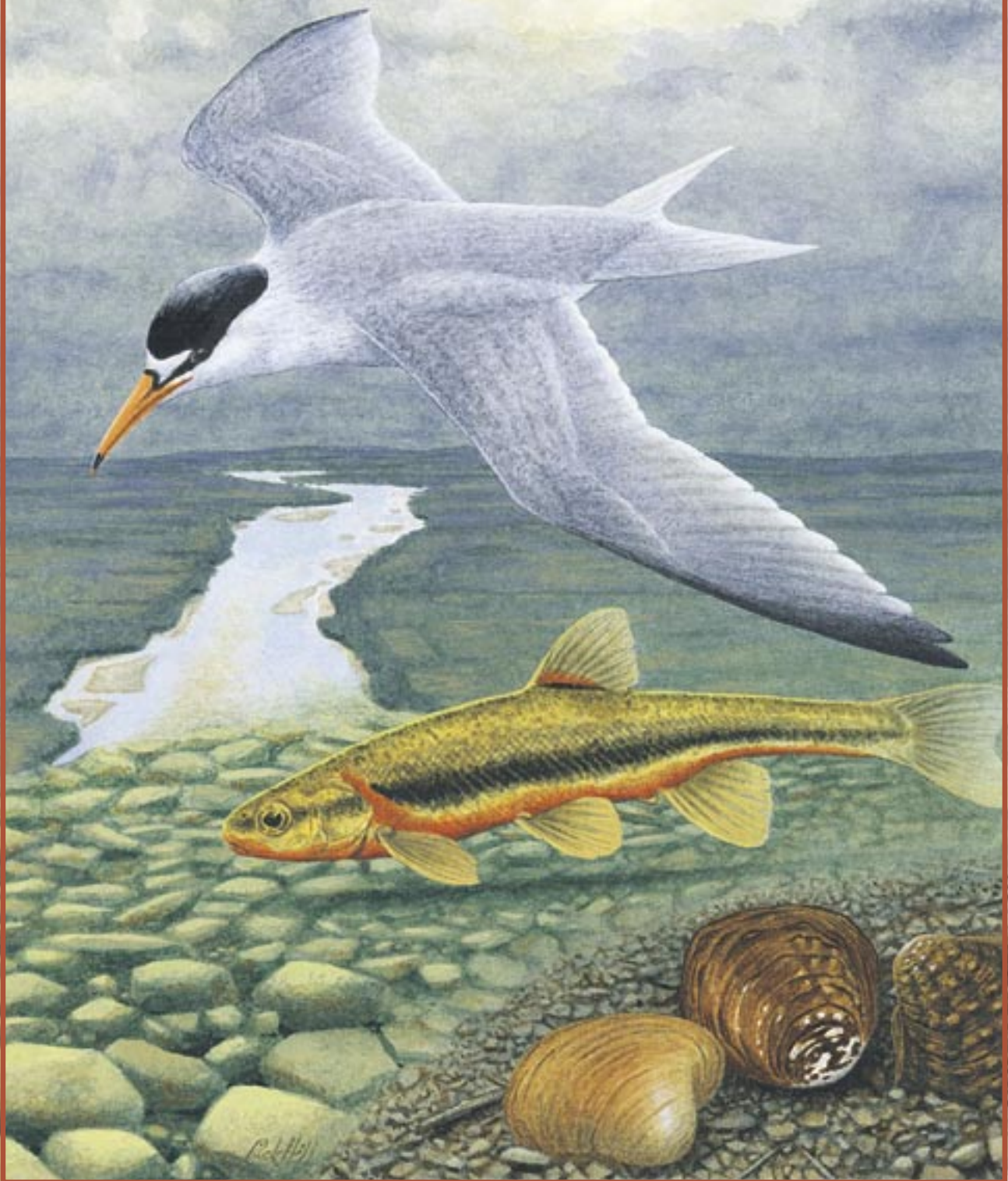


KENTUCKY'S *Threatened and Endangered* SPECIES



Kentucky Department of Fish and Wildlife Resources



Our Mission

We are stewards of Kentucky's fish and wildlife resources and their habitats. We manage for the perpetuation of these resources and their use by present and future generations. Through partnerships, we will enhance wildlife diversity and promote sustainable use, including hunting, fishing, boating and other nature-related recreation.

**Kentucky Department of
Fish and Wildlife Resources**

KENTUCKY'S *Threatened and Endangered* SPECIES



Compiled and Edited by
Tim Slone & Traci Wethington
Endangered Species Biologists

Kentucky Department of Fish and Wildlife Resources
1998
Revised 2001

The Kentucky Department of Fish and Wildlife Resources does not discriminate on the basis of race, color, national origin, sex, religion, age or disability in employment or the provision of services and provides, upon request, reasonable accommodation including auxiliary aids and services necessary to afford individuals with disabilities an equal opportunity to participate in all programs and activities.

ACKNOWLEDGMENTS

This publication was developed by Kentucky Department of Fish and Wildlife Resources in cooperation with Kentucky State Nature Preserves Commission and was partially funded by the U.S. Fish and Wildlife Service under Section 6 of the Endangered Species Act.

AUTHORS:

Kim Hermes
Tim Slone
Traci Wethington
Deborah White

LAYOUT AND DESIGN:

John Boone

COVER ART:

Rick Hill

CONTENTS

INTRODUCTION	2
---------------------	---

MAMMALS

Virginia big-eared bat	4
Gray bat	4
Indiana bat	6

BIRDS

Peregrine falcon	7
Bald eagle	8
Red-cockaded woodpecker	9
Interior least tern	11

REPTILES

Copperbelly water snake	11
-------------------------	----

FISH

Relict darter	12
Duskytail darter	13
Palezone shiner	14
Blackside dace	15
Pallid sturgeon	16

INSECTS

American burying beetle	16
-------------------------	----

CRUSTACEANS

Kentucky cave shrimp	17
----------------------	----

MUSSELS

Cumberland elktoe	20
Fanshell	20
Cumberlandian combshell	21
Oyster mussel	21
Catspaw	22
Northern riffleshell	22
Pink mucket	23
Ring pink	23
Little-wing pearly mussel	24
Orange-foot pimpleback	24
Clubshell	25
Rough pigtoe	25
Fat pocketbook	26
Cumberland bean	26

PLANTS

Price's potato-bean	27
Braun's rock cress	27
Cumberland rosemary	28
Eggert's sunflower	29
Cumberland sandwort	30
White-haired goldenrod	30
Short's goldenrod	31
Virginia spiraea	32
Running buffalo clover	33

PHOTO CREDITS	34
----------------------	----

Kentucky's Threatened and Endangered Species

INTRODUCTION

Contained within the boundaries of Kentucky is an amazing diversity of plants and animals. This tremendous diversity is linked to the wide range of habitat types that are found in Kentucky. From the swamps and sloughs in the West to the mountainous highlands in the East, Kentucky's landscape changes dramatically in all directions. The streams and rivers of our state contain a diversity of life so rich and varied that they have been compared to tropical rainforests. When Daniel Boone first crossed the Cumberland Gap, he must have marveled at the variety of plants and animals that he found.

Times have changed since Daniel Boone crossed the mountains in 1776. As the human population of Kentucky has grown, the land has been changed. Forests have been replaced with subdivisions; swamps have been drained for farms; rivers have been dammed to create reservoirs; and streams have been choked with silt from mining and logging operations. A few species have benefitted from these changes but many more have declined. Kentucky has a growing number of species that are in trouble. Some plants and animals are being pushed to the very brink of extinction. For most of these species, there is still hope. By protecting the remaining habitats that these plants and animals need, we can insure their survival.

Plants and animals discussed in this book are listed under the federal Endangered Species Act. In 1973, the United States Congress passed the Endangered Species Act. The Endangered Species Act is one of the most powerful laws ever enacted to prevent the extinction of plants and animals. The act protects plant and animal species and their habitats that may face extinction unless action is taken. Factors the U.S. Fish and Wildlife Service considers in the decision to list a species are:

1. the present or threatened destruction, modification, or curtailment of its habitat or range;
2. overutilization for commercial, recreational, scientific, or educational purposes;
3. disease or predation;
4. the inadequacy of existing regulatory mechanisms;
5. other natural or manmade factors affecting its continued existence.

Many species are in danger of disappearing from Kentucky but not necessarily from their entire range. Although there are no state laws protecting these species, the Kentucky State Nature Preserves Commission maintains a list of species for Kentucky that are considered endangered, threatened, or of special concern. The Kentucky Department of Fish and Wildlife Resources and the Kentucky State Nature Preserves Commission gather information on the biology and habitat of rare species that helps to determine the reasons for their decline and to focus protection efforts.

Government agencies and private conservation organizations are working to slow or reduce the loss of habitat in our state but working alone cannot solve the problems facing wildlife today. All Kentuckians have a role to play in protecting our natural heritage. Ultimately, the citizens of Kentucky will decide the fate of our endangered species.

DEFINITIONS

ENDANGERED: Species in imminent danger of extinction throughout all or a large part of their range.

THREATENED: Species that are likely to become endangered within the foreseeable future.

ENDEMIC: A plant or animal restricted to a particular area, region, or river system.

RELICT: A plant or animal species living in isolation in a small local area, or as a remnant of an almost extinct group.

EXTIRPATED: Species that have disappeared from Kentucky but still exist elsewhere.

EXTINCT: Species that no longer exist.

HABITAT: The place where a plant or animal lives that provides food, water, shelter, and space.

ABOUT THE MAPS

The range maps in this book represent the current county distribution in Kentucky. Many of these species occupied a much larger area in the past. Distribution information is a compilation of data from Kentucky State Nature Preserves Commission and the Kentucky Department of Fish and Wildlife Resources. While individuals of some species may occasionally be seen in counties not indicated on the maps, these individuals are considered to be transients.

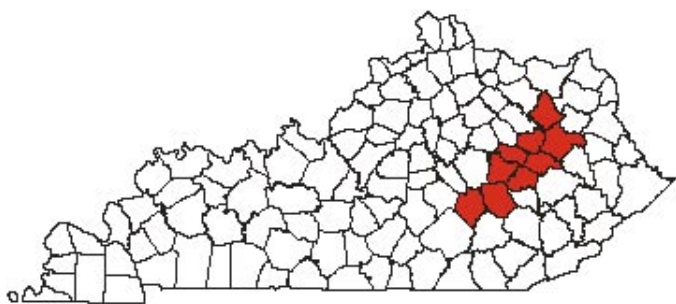


Virginia Big-eared Bat

Corynorhinus townsendii virginianus

Status: Endangered

Description: The Virginia big-eared bat is a medium-sized bat, approximately 3.5-4.5 inches in length. Characteristic features are its large ears, which are more than one inch long, and the presence of two large lumps (glands) on the muzzle. The Virginia big-eared bat can be distinguished from the Rafinesque's big-eared bat, the only similarly looking species found in Kentucky, by fur color and toe hairs. The Virginia big-eared bat is pale to dark brown on the back and light brown on underneath. In contrast, the Rafinesque's big-eared bat is gray-brown on the back with whitish underparts. The Rafinesque's big-eared bat also has hairs on its feet that extend past the toes, whereas the Virginia big-eared bat has short toe hairs.



Range: Virginia big-eared bats occur in isolated populations in eastern Kentucky, eastern West Virginia, southwestern Virginia, and northwestern North Carolina.

Habitat: Virginia big-eared bats prefer caves in karst regions (i.e., areas underlain with limestone bedrock and many caves and sink holes) dominated by oak-hickory or beech-maple-hemlock forest. These bats hibernate in tight clusters in areas of caves where temperatures usually range from 32 to 54 degrees F and are often near entrances in well-ventilated areas. In summer, maternity colonies (see below) are found in the relatively warm parts of caves.



Life History: This nonmigratory bat resides in caves year round. Mating occurs in fall and winter, and females store sperm over winter. Ovulation and fertilization take place in the spring shortly after females arouse from hibernation. In summer, females congregate to form what is known as maternity colonies where they bear their young. It is not known where most of the males spend the summer. Each female gives birth to a single offspring (pup) in June. Young can generally fly within three weeks. Moths are the primary prey for this species.

Causes of Decline: Human disturbance is probably the biggest factor contributing to the decline of these bats. Disturbance during hibernation causes bats to lose stored fat reserves, and repeated disturbances can cause the bats to die before spring when insects are again available. If female bats are disturbed during the maternity season, they may drop their young to their deaths or the whole colony may abandon a roost for a less suitable location.

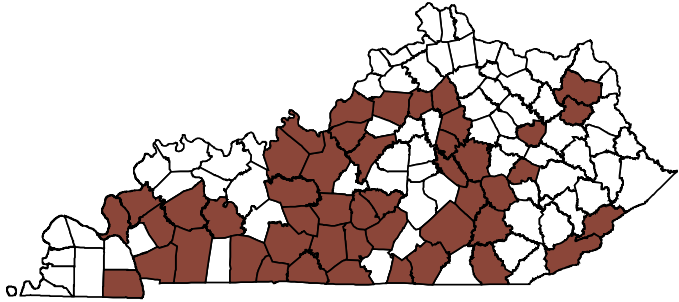
Gray Bat

Myotis grisescens

Status: Endangered

Description: The gray bat, 3-4 inches in length, is the largest species of *Myotis* found in the eastern U.S. Its fur is gray, sometimes russet in summer. It is the only *Myotis* with the wing membrane attached to the ankle (instead of at the base of the toe), and the only bat in its range with dorsal (back) hair that is uniform in color from base to tip.

Range: The core range of the gray bat encompasses the cave regions of Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. Populations also occur in portions of Florida, Georgia, Kansas, Indiana, Illinois, Oklahoma, Mississippi, Virginia, and possibly North Carolina.



Habitat: Gray bats are restricted to caves or cave-like habitats. Few caves meet their specific roost requirements. This results in about 95 percent of the population hibernating in only 8 or 9 caves. For hibernation, the roost site must have an average temperature of 42 to 52 degrees F. Most of the caves used by gray bats for hibernation have deep vertical passages with large rooms that function as cold air traps. Summer caves must be warm, between 57 and 77 degrees F, or have small rooms or domes that can trap the body heat of roosting bats. Summer caves are normally located close to rivers or lakes where the bats feed. Gray bats have been known to fly as far as 12 miles from their colony to feed.

Life History: Gray bats roost, breed, rear young and hibernate in caves year round. They migrate between summer and winter caves and will use transient or stopover caves along the way. Mating occurs as bats return to winter caves in September and October. By November, most gray bats are hibernating. Adult females begin to emerge in

late March, followed by juveniles and adult males. Females store sperm over winter and become pregnant the following spring. A few hundred to many thousands of pregnant females congregate to form maternity colonies. Males and nonreproductive females gather in smaller groups to form what are known as bachelor colonies. A single pup is born in late May or early June. Young begin to fly 20 to 25 days after birth. Gray bats primarily feed on flying insects over rivers and lakes. Aquatic insects, particularly mayflies, make up the majority of their diet.



Causes of Decline: Since gray bats are found in caves year round, they are very vulnerable to human disturbance. This has contributed greatly to their decline. As with any cave bat, alterations of caves and cave entrances (e.g., commercialization and improper gating) have negatively affected their populations. Gray bats also have been killed during natural flooding and flooding caused by manmade impoundments. The overuse of pesticides has also contributed to their decline. Pollution and siltation of streams causing a reduction in aquatic insects may also affect gray bat populations.

"Instead of learning more about less and less, we must learn more and more about the whole biotic landscape."

Aldo Leopold

Indiana Bat

Myotis sodalis

Status: Endangered

Description: The Indiana bat is a medium-sized bat, 3.5 inches in length, with dark gray to brownish black fur. Characteristics which help distinguish it from similar species include a pinkish nose; small hind feet with sparse, short hairs that do not extend beyond the toes; and a calcar (i.e., the spur extending from the ankle) that has a slight keel. Its hair is less glossy in appearance than that of little brown bats.

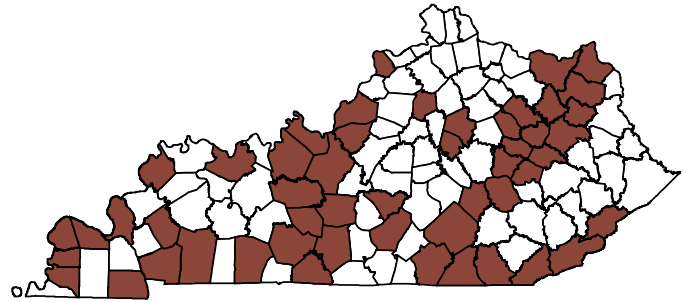
Range: The Indiana bat is found throughout much of the eastern U.S. from Oklahoma, Iowa, and Wisconsin, east to Vermont and south to northwestern Florida.



Habitat: For hibernation, the Indiana bat prefers limestone caves with stable temperatures of 39 to 46 degrees F. As with the gray bat, few caves meet the specific roost requirements of this species. Subsequently, more than 85 percent of the population hibernates in only 9 sites. Summer habitat requirements are not completely known for the Indiana bat. Floodplain and riparian forests serve as important habitats for both foraging and roosting;

however, other habitats are utilized. Indiana bats typically roost under loose bark in the summer.

Life History: Indiana bats mate in the fall and begin entering hibernation in October. Males tend to be active longer in the fall, but are in hibernation by late November. During hibernation, Indiana bats cluster tightly together and consequently are sometimes called the social bat. Having stored sperm over winter, female bats become pregnant soon after emergence in late March and early April.



Females will emerge from hibernation and migrate to summer habitat before males. During summer, maternity colonies can be found under loose tree bark and usually consist of less than 100 individuals. Some males do not migrate and spend the summer near the hibernacula; others will roost in similar habitat as the females but in smaller numbers. Females will bear a single pup in late June or early July. Young bats are able to fly within one month after birth. Small moths are a major part of the Indiana bat's diet, though many different kinds of flying insects are taken.

Causes of Decline: Decline in Indiana bat numbers likely have been caused by several factors. Unfortunately, most are due to human activity. Indiana bats suffered great losses in the past because of man-made changes to cave entrances. Structures built to restrict humans have also hindered the movement of bats. These structures have also caused changes in air flow, temperatures, and humidity levels that have made the caves less suitable for bats. Human disturbance is always a factor with hibernating bats, and because Indiana bats gather together in large numbers during the winter, they are even more vulnerable to disturbance. Thousands of Indiana bats have also died at the hands of vandals. The most important hibernacula are now protected;

however, Indiana bat numbers continue to decline. Some bats are lost periodically to flooding caused by natural events or man's activities. Loss of forest habitat may be affecting maternity and foraging areas. As with all bats that feed primarily on insects, Indiana bats have probably suffered declines due to use of pesticides.

Peregrine Falcon

Falco peregrinus

Status: Delisted - (formerly endangered)

Description: The crow-sized peregrine falcon is a streamlined, high-speed flyer with superior eyesight, pointed wings, and a moderately long tail. Adults have a distinctive dark hood and mustache, cream-colored throat, blue barring on the feathers, and yellow legs and feet. Young birds are brownish with a streaked breast and bluish gray beak, legs and feet. With a 45-inch wingspan, adult females weigh 2 pounds or more and are one-third larger than males.

Range: A widely distributed bird of prey, peregrines are found on every continent except Antarctica. In Kentucky, peregrines once nested on cliffs at scattered points across Kentucky, including the Cumberland Mountains, in the Cumberland Plateau, and along the Kentucky and Ohio River valleys. A small tree nesting population, now extinct, once nested in the swamplands of western Kentucky. It is also likely that peregrines once inhabited buildings in urban areas

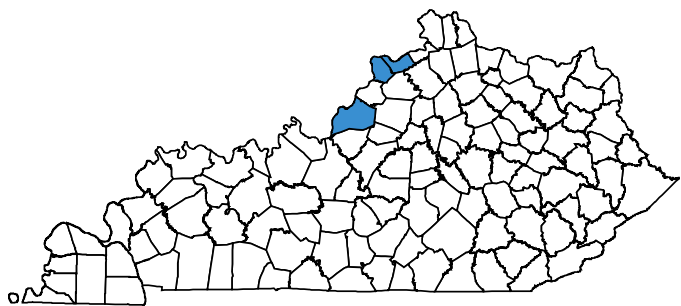
Habitat: Peregrines are primarily found along rivers and lakes where cliffs dominate the landscape. Cliffs used for nesting are usually steep and rocky

with an eastern or northeastern exposure. The eyrie (nest site) itself is usually situated in a shallow hole, crevice, or ledge often among sparse vegetation. Falcons utilize open habitats for foraging, such as weedy fields, waterways, and wetlands. Peregrines predominantly used forested habitats in Kentucky prior to their decline. Since restoration, the majority of falcon nesting activity in Kentucky and throughout the Midwest has occurred in urban areas.

Life History: Peregrines feed mostly on medium-sized birds, such as pigeons, shorebirds, and songbirds, and will occasionally take ducks. Capable of vertical dives of 200 miles per hour, peregrines are considered the fastest animals on earth. As a predator at the top of the food chain, peregrines have few enemies. Great horned owls are, however, a threat to young peregrines.



Peregrine falcons typically begin breeding at 2 or 3 years of age. They are usually monogamous and return to nest on the same territory year after year. Peregrines usually breed in late winter or early spring. Males arrive first in the breeding areas, most of which are occupied by February's end. Performing spectacular aerial courtship displays at the start of the breeding season, males attempt to attract a female to a specific ledge along a cliff.



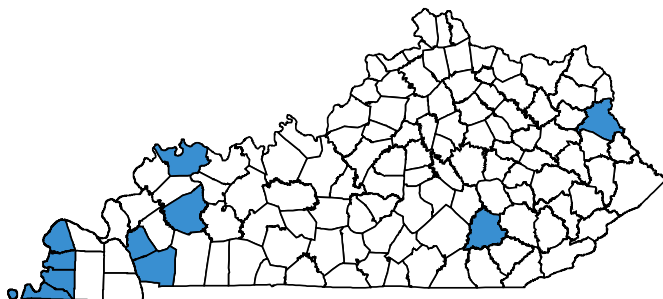
By April, nesting activity is underway. Falcons make their nests, or scrapes, by making a shallow depression in rocks and debris. Three to four cream-colored eggs with pink or dark red blotches are typically laid. Eggs hatch after 30 days, and 40 to 50 days later the youngsters are ready to try their wings. Only about 30 percent of young peregrines survive each year; mortality is due largely to weather, disease, and accidents. The life span of peregrines averages 6 to 8 years, although some may live for 20 years.

Causes of Decline: Peregrine populations suffered large-scale declines in the mid 1900s, primarily because pesticide contamination (mainly DDT) affected nesting success. Due to a ban on the use of DDT, reproductive success improved and populations began increasing. During the 1970s, programs were begun to restore peregrine populations by releasing young birds that had been hatched in captivity.

KDFWR has been releasing falcons in Kentucky since 1993. Falcons usually return to their fledging site to nest. Biologists hope that breeding pairs of released falcons will return to the release sites to nest, eventually leading to self-sustaining peregrine populations in Kentucky.

Hudson Bay to Newfoundland, and south to southern Florida and Baja, California. They are absent as a breeding species throughout much of their former range outside Alaska and peninsular Florida.

Bald eagles are rare summer residents in western Kentucky; however, they are increasingly common during the winter. Depending upon the severity of the winter, 150 to 350 eagles may winter in Kentucky. In winter, eagles may be spotted at Land Between the Lakes, Ballard Wildlife Management Area, Dale Hollow Lake, Lake Cumberland, and



many other reservoirs throughout the state. Man-made reservoirs have increased the state's eagle numbers by providing attractive habitat. Prior to restoration efforts, eagles had not nested in Kentucky since 1949. Eagles nested successfully in Kentucky at the Land Between the Lakes area in 1989. Since that time, the number of eagle nests has

Bald Eagle

Haliaeetus leucocephalus

Status: Threatened

Description: Named for the all white or bald (the Old English *balde* meaning white) head, adult bald eagles are large dark-brown birds with bright yellow bills, eyes, and feet. An adult's body is 3-3.5 feet in length with a wingspan of 6-7.5 feet. Juveniles in their first year are uniformly brown, while older juveniles have variable amounts of white plumage giving them a blotchy, mottled appearance. Adults have developed their distinctive white head and tail by 5 years of age.

Range: Bald eagles occur only in North America; from Alaska east around the southern shores of



been increasing and has surpassed the number of nests the state had before the species' decline.

Habitat: Bald eagles are found mostly along major rivers and large, open bodies of water where fish, waterfowl, and other prey are abundant. They prefer large trees along water for daytime perches. Eagles often roost in small groups during winter months.

Life History: Bald eagles bond to the territories for life and usually select nest sites close to where they were raised. They do not usually nest successfully until they are 3 to 5 years old. Nests are bulky structures averaging 7 to 8 feet across and can be 12 feet deep. The nests, composed of limbs and sticks and lined with moss, pine needles, or other vegetation, are constructed in tall trees. Eagles revisit nests each year and add to the structures. Although only one nest is used in a given season, the pair will often build multiple nests within a single territory.

Wintering bald eagles begin arriving in Kentucky as early as October and stay through late February or early March. Most come from the Great Lakes Region, migrating south to the first open water they find. Courtship may begin as early as December and last through February. Eggs are laid in late February or early March and hatch after 35 days. Eaglets begin flying at 9 to 12 weeks of age. The life span of a bald eagle is quite long; eagles in the wild may live to be 20 to 30 years old.

Bald eagles fly up to 35 miles per hour during normal flight and reach much higher speeds when diving for prey. Eagles feed primarily on fish, but also feed on waterfowl and occasionally carrion. As a predator at the top of the food chain, bald eagles have few enemies; however, young eagles are occasionally taken from the nest by great horned owls.

Causes of Decline: Bald eagles once nested throughout the nation. However, the use of pesticides, especially DDT, between the 1940s and 1972 caused a steep decline in eagle populations. Bald eagles were listed as endangered by the U.S. Fish and Wildlife Service. A ban on the use of DDT in 1972, habitat protection, and nationwide resto-

ration efforts led to increases in the populations and the subsequent downlisting to threatened status in 1995.

Steps to be taken for recovery: retain large trees and snags around lakes, rivers and wetland areas to encourage use by eagles, protect wintering and nesting areas from human disturbance, immediately report poaching incidents, and continue to monitor and protect winter and nesting populations.

Red-cockaded Woodpecker

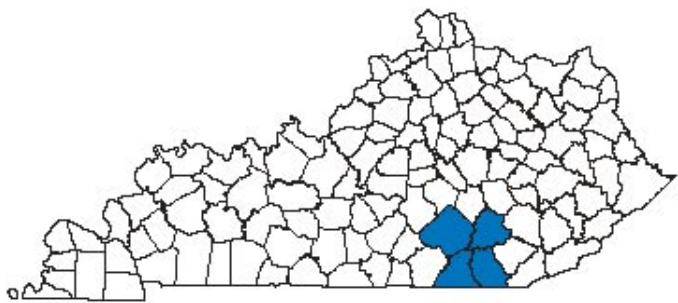
Picoides borealis

Status: Endangered

Description: A medium-sized bird, averaging 7.25 inches in length, the red-cockaded woodpecker has prominent white cheek patches, a black-and-white barred back, and a solid black cap and nape. The male has a tiny red tuft behind the eye near the ear



(the cockade). The call notes of the red-cockaded woodpecker are a raspy *shrip* or a higher-pitched, longer call.



Range: The red-cockaded woodpecker in Kentucky is at the northern edge of its range. This species occurs mostly south and east of Kentucky in the Coastal Plains region from Virginia to Texas. In Kentucky, the majority of red-cockaded woodpecker sites are known from the Cliff Section of the Cumberland Plateau. Currently, occupied red-cockaded woodpecker sites are known to occur only on the Daniel Boone National Forest.

Habitat: Red-cockaded woodpeckers develop cavities in live pine trees for nesting and roosting. These live pines are usually 80+ years old and often infected with a heart rot fungus, which makes cavity excavation easier for the birds. Red-cockaded woodpeckers develop what is known as pitch wells around their cavity entrance to create resin flow down the tree. This resin coating is thought to discourage potential predators like snakes from climbing the tree and preying on the woodpeckers. Pine species that may be utilized by the woodpeckers in Kentucky for cavity development include shortleaf, pitch, and Virginia.

In the southern portion of their range, red-cockaded woodpeckers typically prefer open pine forests (mostly longleaf pine) with grassy understory, maintained by periodic fire. In Kentucky, their habitat is mostly mixed pine-hardwood forest located on ridges. Fire plays an important part in maintain-

ing red-cockaded woodpecker habitat by reducing competition from hardwoods while encouraging the growth of pine trees.

Life History: Red-cockaded woodpeckers live in extended family groups or clans, which may consist of a single breeding pair, their offspring, and adult male helpers from previous years of reproduction. The helpers assist the breeding pair with incubation, feeding of young, and territory defense. A single group may require several roost trees in their nesting location, referred to as a cluster. Woodpeckers nest between late March and July, producing one clutch of chicks during this time. The breeding female will lay 2-4 eggs, usually in the roost tree of the breeding male. The eggs will hatch in 10-12 days. All members of the clan help incubate and feed the young. The hatchlings will leave their nest cavity in about 26 days to forage for food on their own.

Insects are the main food source for red-cockaded woodpeckers. The woodpeckers search for food under the bark and along the limbs of trees within their foraging territory. They may also eat fruits on occasion.

Causes of Decline: Red-cockaded woodpeckers have declined due to the loss of mature pine forests. Conversion for farming, fire suppression, and timber harvest have combined to reduce the amount of mature pine forests in the southeastern United States.

The red-cockaded woodpecker population in Kentucky has declined so severely that the U.S. Forest Service has begun moving birds from other southern forests to the Daniel Boone National Forest in an attempt to supplement our native population. Protection efforts for these birds include continued monitoring of individual populations, protecting and managing for mature pine forest habitat, and continued research of red-cockaded woodpecker ecology.

"The first rule of intelligent tinkering is to save all the pieces."

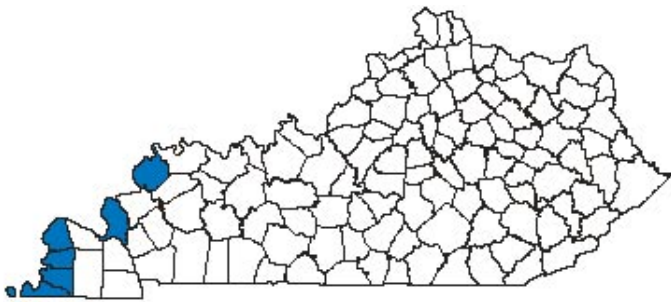
Aldo Leopold

Interior Least Tern

Sterna antillarum athalassos

Status: Endangered

Description: As the smallest member of the tern family, the interior least tern has a wingspan of 20 inches. It has a grayish back and wings and a snowy white underside. These terns can be distinguished from all other terns by the combination of a black crown, white forehead, and a variable black-tipped yellow bill. The interior least tern's call is a sharp *killick* or *kip-kip-killick*.



Range: The interior least tern occurs in or near the major river systems of Midwestern United States. It winters from the Gulf Coast southward. In Kentucky, the interior least tern is a summer resident. It nests along the Mississippi and lower Ohio Rivers.

Habitat: This tern favors sandbars in large rivers for nesting. Nesting areas must be free of vegetation to be used by terns. Least terns prefer shallow water for fishing. Water levels must remain relatively consistent so that nests stay dry.

Life History: Interior least terns likely winter along the Gulf Coast from Texas to northern South America. They arrive at breeding sites from late April to early June where they typically spend four to five months. Pairs go through an elaborate courtship period that includes courtship feedings and a variety of postures and vocalizations. Least terns nest in small colonies on exposed flats, river sandbars, or reservoir beaches. Nests are small scrapes in the sand. Typically 2-3 eggs are laid. The young are fairly mobile soon after hatching. Both parents feed the young and remain with them until fall



migration. Terns will travel 4 miles or more from their breeding colonies to find the small fish that make up the major part of their diet.

Causes of Decline: The interior least tern was probably more widespread in Kentucky as a nesting bird in the previous century. Navigation dams have caused changes in the rivers resulting in the loss of sand and gravel bars. Recreational use of the remaining sandbars makes them less suitable for least tern nesting. Human disturbance may cause adults to abandon eggs or young. Protection efforts for this small tern include: determining population trends and habitat requirements, increasing breeding habitat, and developing public awareness of the needs of least terns.

Copperbelly Water Snake

Nerodia erythrogaster neglecta

Status: The status of the copperbelly water snake is unique among Kentucky's imperiled species. A Habitat Conservation Agreement was developed to protect the animal and its habitat while preventing the need to add it to the threatened and endangered species list. The Kentucky Department of Fish and Wildlife Resources led a group composed of state and federal agencies, the Western Kentucky Coal Association, and the Kentucky Farm Bureau in working out this landmark agreement.

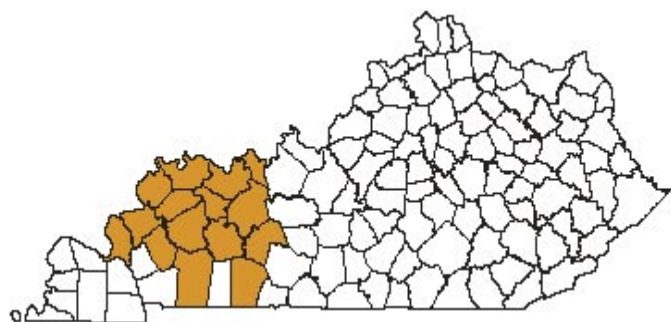
Description: The copperbelly water snake is a distinct subspecies of the plainbelly water snake. Adults reach a length of between 30 and 48 inches. The copperbelly water snake has a dark (usually black) back with a bright orange-red belly. Blotches of dark pigment extend onto the belly scales.



Range: Historically, the range of the copperbelly water snake included south central Michigan and northwestern Ohio, southwestward through Indiana to southeastern Illinois and western Kentucky. In Kentucky, the copperbelly water snake is now restricted to isolated populations in the Western Coalfield Region.

Habitat: The copperbelly water snake is found in swamps, sloughs and bottomland hardwood forests. Upland areas adjacent to these habitat types are also utilized mainly as travel corridors.

Life History: Copperbelly water snakes emerge from hibernation in early spring and migrate to shallow water wetland areas. They mostly feed on



frogs, tadpoles, and salamanders. When these shallow swamps dry up, the snakes migrate to nearby forested areas. Upland areas provide the snakes with important summer habitat, as well as providing corridors for movement from one wetland to another. Copperbelly water snakes spend most of summer along the forest edge. The copperbelly may spend less time around water than any of the other water snakes. In the fall, the snakes begin to move toward their hibernation sites. Young snakes are born in the fall in or around the hibernaculum. The average size of a litter is 18 or fewer.

Causes of Decline: Loss of habitat has caused the decline of the copperbelly water snake. Historically, the conversion of bottomland hardwood forest to cropland has been the principal factor in habitat loss. Current threats to habitat include conversion to cropland, surface coal mining, channelization of streams, and urban and commercial development.

Relict Darter

Etheostoma chienense

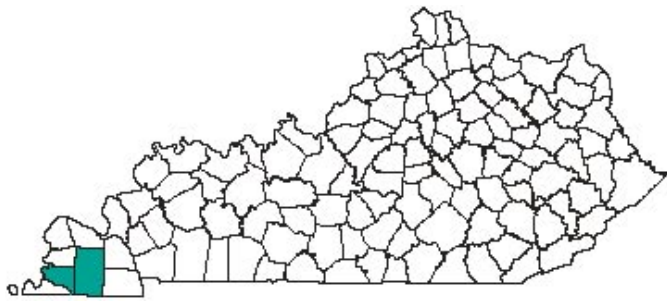
Status: Endangered

Description: Relict darters are small, being only 2.5 inches in length. Coloration is a light tan on the backs and sides with six to eight dark brown saddles present. The undersides are white and unmarked. Breeding males have gray to dark brown sides and backs.

Range: The relict darter is known only from the Bayou du Chien, a small stream in far western Kentucky.

Habitat: The Bayou du Chien is a small, sand and mud bottomed stream. Adults concentrate in head-water areas in gently flowing pools, over bottoms of gravel mixed with sand. Relict darters utilize cover such as fallen trees, undercut banks, and overhanging vegetation.

Life History: Relict darters are bottom dwellers. Spawning begins in March and lasts until early



Duskytail Darter

Etheostoma percnurum

Status: Endangered

June. During spawning the male and female briefly invert, and the female deposits her eggs in a single layer on the underside of a hard substrate. A variety of substrates are used for nesting structures. These substrates include rocks, logs, tree bark, and even rubbish like old road signs, roofing shingles, and air conditioner frames. The male then guards the eggs until they hatch. The food habits of the relict darter are unknown, but their diet probably consists of aquatic insects and small crustaceans.

Description: This small fish which rarely exceeds 2.25 inches in length belongs to a category of fish known as darters. The body color is brown with a series of dark brown vertical bars on the sides. Breeding males have a dark head and a milky white anal fin. Fleshy golden knobs develop on the tips of the dorsal spines.

Range: In Kentucky, this fish is only found in that section of the Big South Fork of the Cumberland River lying within the Big South Fork National Recreation Area. Duskytail darter populations are known to exist in only three other locations: Citico Creek, TN, Little River, TN, and Copper Creek, VA. Two other populations of this species are now believed to be extirpated.



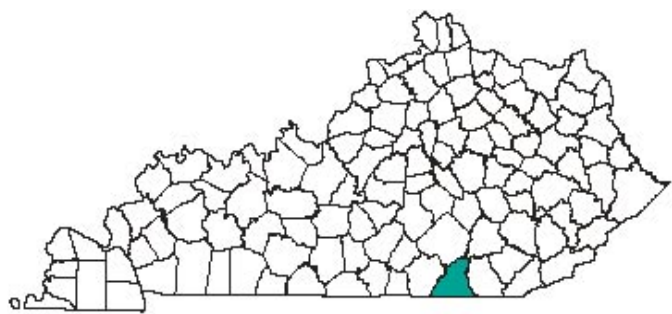
Causes of Decline: The channelization of large reaches of Bayou du Chien and its tributaries has drastically altered the relict darter's habitat. Many areas of the stream with undercut banks and gravel deposits that formerly supported relict darters were destroyed. Channelization also removed in-stream cover such as flat rocks and logs that are used as breeding sites. The destruction of vegetation that shades and protects the stream banks along with poor farming practices have increased siltation. Spawning fish are forced to use rubbish because natural spawning materials have been removed or are covered in silt. Research on the use of artificial spawning structures is being conducted.



Habitat: The duskytail darter is found in large clear streams and moderate sized rivers. It prefers pools 1 to 4 feet in depth that are located at the heads of riffles. Pool bottoms are generally covered with large rocks overlying sand and gravel. The duskytail is only found in areas with little or no siltation.

Life History: Like other darters, duskytails spend most of their time on the bottom of the stream. Their coloration serves to camouflage them. When

disturbed they will dart to cover. Duskytails feed on small crustaceans and aquatic insect larvae. Breed-



ing takes place in late April and lasts through June. A male will establish his territory under a large flat rock. The female will turn upside down and deposit her eggs in a cluster on the underside of this large rock. The male then fertilizes and guards the eggs until they hatch.

Causes of Decline: The duskytail darter was once a more widespread species than it is today. Like some other darter species, it is dependent on clear rocky pools that are free of silt. Siltation, pollution, and impoundments have destroyed much of their former habitat.

Palezone Shiner

Notropis albizonatus

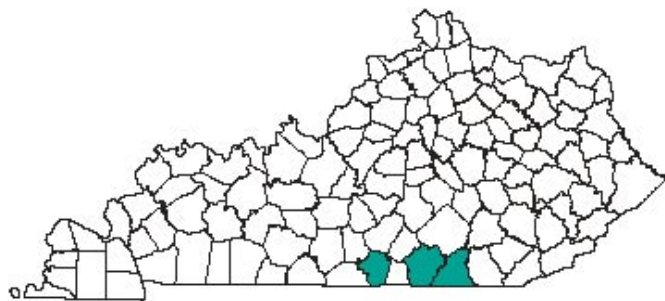
Status: Endangered

Description: The palezone shiner is a small, slender minnow. This fish reaches a maximum length of 2.5 inches. The body is a light, translucent straw color. Extending the length of the body, just above a dark lateral stripe, is the “pale zone.” The “pale zone” is a broad stripe that contains very little pigment and contrasts with the dark lateral stripe. Dark blotches are present before the dorsal and caudal fins.

Range: The palezone shiner is presently known from two disjunct populations: the Paint Rock River in Jackson County, Alabama, and the Little South Fork of the Cumberland River in Wayne and McCreary Counties, Kentucky. Populations at Marrowbone Creek,

Cumberland County, Kentucky, and Cove Creek, Campbell County, Tennessee, have been extirpated. This fish was probably more widespread within the Tennessee and Cumberland River systems at one time.

Habitat: The palezone shiner is found in large streams and small rivers in the Tennessee and Cumberland River systems. It is found in the flowing pools and runs of upland streams. This shiner prefers bottoms composed of sand, gravel, and cobble.



Life History: Very little is known about the life history of the palezone shiner. It spawns in June and July. This fish is currently being studied in an attempt to find out more about its ecology.

Causes of Decline: Populations of this species have been fragmented by impoundments. Reservoir construction has been the primary factor leading to the decline of the palezone shiner. Other factors include the removal of the shade-producing vegetation beside streams, channelization, increased siltation from poor farming and mining practices, and the deforestation of watersheds.





Blackside Dace

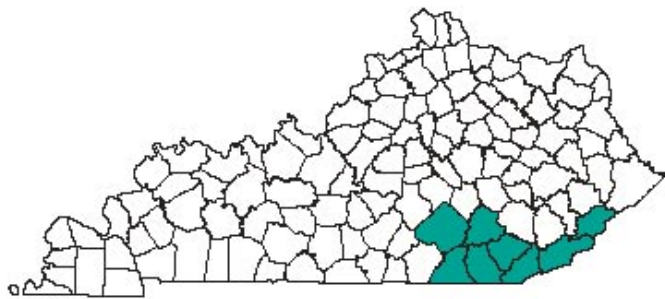
Phoxinus cumberlandensis

Status: Threatened

Description: The blackside dace is a small fish, usually less than 3 inches long. They have olive or gold colored backs and are silver-white or red along the underside. Two dark stripes run along each side of the fish's body. During the breeding season, the bellies of the males are bright red while the fins are bright yellow and trimmed in silver.

Range: Blackside dace are found in the upper Cumberland River drainage, mostly above Cumberland Falls. They are found primarily in Kentucky with a few small populations being known from Tennessee.

Habitat: Blackside dace inhabit small, cool, upland streams in forested areas. The forest adjacent to the stream keeps the water cool and minimizes the runoff of silt. Stream bottoms are composed of sand, sandstone, or shale substrates. Dace are found in pools near undercut banks or other cover such as brush or large rocks.



Life History: Blackside dace are small, secretive fish that spend most of their time in pools near undercut banks or other cover. They feed on algae which they find attached to rocks or other objects on the stream bottom. In the winter they feed on aquatic insects. Spawning begins in April and extends into July. Spawning takes place over silt free gravel areas. The life span of a blackside dace is around 3 years.

Causes of Decline: The range of the blackside dace coincides with the coal-rich regions of Kentucky and Tennessee. Surface mining for coal has heavily impacted many dace populations and their habitat. Silt and acid mine drainage have caused declines



in blackside dace populations and continue to be a threat. Logging is also a threat to dace populations. The canopy of trees over blackside dace streams keeps the water cool and prevents erosion of the stream bank. When logging activities remove this canopy, the stream quickly becomes degraded.

"When we try to pick out anything by itself, we find it is attached to everything else in the universe."

John Muir

Pallid Sturgeon

Scaphirhynchus albus

Status: Endangered

Description: Pallid sturgeons are elongate fish with bodies covered by five rows of keeled, bony scutes or plates. The body color is pale gray to yellowish white. The head is sloped, with a short, broad, snout, and a small eye. In adults, the mouth



Shovelnose sturgeon (top) and pallid sturgeon (bottom)

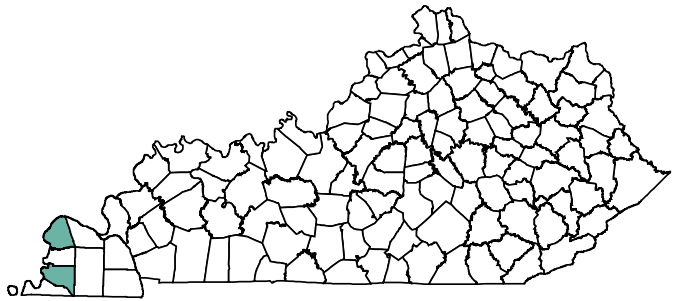
is toothless with fleshy lips. Four barbels (whiskers) are located between the mouth and the end of the snout. The inner barbels are only one-half as long as the outer barbels. Mature fish can reach 35 inches in length.

Range: The pallid sturgeon is native to the Missouri and Mississippi Rivers. In Kentucky, this species is known only from the mainstem of the Mississippi River.

Habitat: The pallid sturgeon is a fish of large rivers. It prefers muddy or silty waters with moderate currents. This fish is usually found over a firm sand bottom mixed with gravel and mud.

Life History: Little is known about the life history of this rare fish. The main food source consists of bottom dwelling insects, other invertebrates, and small fish. Spawning occurs in June or July. Pallid

sturgeons are believed to hybridize frequently with shovelnose sturgeons. Research has shown that pallid sturgeons live for more than 40 years and reach weights of more than 60 pounds.



Causes of Decline: The pallid sturgeon is adapted to live in large, free-flowing, warmwater rivers. Humans have altered the sturgeon's habitat by building dams, levees, and channelizing the rivers. These changes in the sturgeon's habitat have blocked fish movement, destroyed spawning areas, reduced food sources, and changed water temperatures. Overfishing, pollution, and hybridization that occur due to habitat changes may also be contributing to this species decline.

American Burying Beetle

Nicrophorus americanus

Status: Endangered

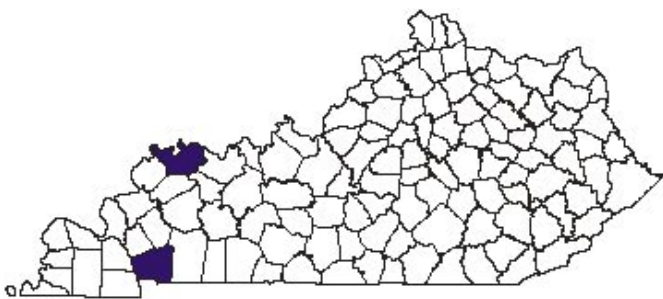
Description: The American burying beetle is a large (1-1.5 inches in length) carrion beetle. It can be distinguished from other beetles by the large orange-red pronotal disk (the area on the upper back below the head) and the two pairs of red spots on the black elytra (wing covers). This beetle also has orange antennae clubs and a red frons (forehead area).

Range: This beetle was once found across eastern North America. Recently, it has been found only in Arkansas, Oklahoma and Rhode Island. The last American burying beetle found in Kentucky came from Trigg County in 1974.



Habitat: Little is known about the habitat requirements of the American burying beetle. Potential habitat for this species is woodland, grassland, or pastureland with enough topsoil to allow beetles to bury dead animals.

Life History: The generally nocturnal American burying beetle lives about one year. It is known for its habit of burying small animal carcasses. The beetle reproduces by burying a carcass and forming an underground chamber near it. Eggs are laid in the chamber with the carcass. One or both parents guard the eggs, then upon hatching, the larvae feed on the carcass. The American burying beetle is unusual among insects in that both parents provide care to their young. Care involves guarding, as well as feeding the young.



Research has shown that the number of eggs laid varies with the size of the carcass, with more eggs being laid on a larger carcass. In the field, brood size has been found to range from 3 to 31. Adults sometimes have more than one brood in a season. These beetles are active on warm (above 60 degrees F) nights.

Causes of Decline: The cause of decline of the American burying beetle is unknown. Insecticides, disease, prey scarcity, and/or habitat loss may be major factors for decline. Protection efforts for this beetle include: protecting and monitoring the existing populations, maintaining captive populations, conducting ecological studies, and conducting field studies for additional populations.

Kentucky Cave Shrimp

Palaemonias ganteri

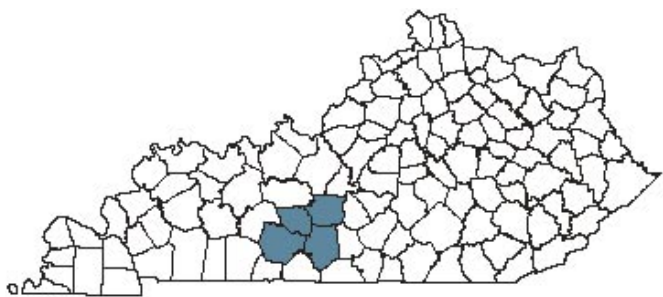
Status: Endangered

Description: This small, blind cave shrimp grows up to 1.25 inches in length. Its body has no pigment, so it is translucent. This freshwater decapod feeds by grazing the surface of sediments in caves, consuming protozoans, algal cells, fungi, and other organic materials.

Range: The cave shrimp is endemic to Kentucky's Barren, Edmonson, Hart and Warren counties.



Habitat: Cave shrimp have very specific habitat requirements. They live only in underground streams. They typically inhabit large, base level cave streams characterized by slow flow, abundant organic material, coarse to fine grain sand, and coarse silt sediments. Though they apparently have no cover or shelter requirements, cave shrimp are



well-adapted to the lightless, deep pools and shallow riffles they inhabit.

Life History: The cave shrimp has a life span of only 1 to 2 years and a low reproductive rate of 14 to 33 eggs per year. Female shrimp have been found with eggs at all times of the year, so reproduction may be continual. However, some evidence suggests seasonal reproduction following flooding events and the subsequent additional food supply. The females carry their clutch of eggs tucked under their abdomen. It is not known whether females reproduce more than once in their lifetime. Eggs hatch and larval stages feed during late summer and fall.

Causes of Decline: The cave shrimp is threatened by contamination of the groundwater flowing into its habitat. The main threats come from inadequately treated or untreated sewage and from accidental spills from traffic accidents or industries. Agricultural development in the region also has the potential to affect cave fauna. Runoff from farming and forest clearing areas can introduce fertilizers, pesticides, herbicides, and sediment into the cave system.

Siltation is another major problem for aquatic life. Increased siltation may cause a decline in the available food supply to small “grazers” like the Kentucky cave shrimp by limiting the habitat for small organisms on the stream bottom. A wide buffer strip of natural vegetation along waterways can help filter out silt from disturbed lands. Livestock and their waste cause pollution and therefore should be kept out of waterways and away from stream banks.

UNIONIDS (Mussels)

INTRODUCTION

Freshwater mussels are one of the most imperiled groups of animals in North America. There are 297 species and subspecies of mussels found in North America. Of the 103 species of mussels native to Kentucky, 18 have completely disappeared from the state, and 34 more are considered rare or endangered.

Mussels have been declining since modern civilization began to bring about habitat changes. This process has been greatly accelerated in the last 100 years. Reservoir construction has been a major factor in the loss of mussel diversity. Reservoirs impact mussel habitat in many ways. Not only is the impounded portion of a river lost as mussel habitat, but the area downstream is also adversely affected. Reservoirs change the properties of the water they discharge. Frequently water is released that is colder and lower in dissolved oxygen than the flow prior to impoundment. Siltation, channelization, and water pollution are all factors that have contributed to the decline of our native mussel populations. The runoff from urban areas has degraded the quality of water and the substrate in many streams. Some mussel populations have become so isolated that they do not have sufficient genetic diversity for long-term survival.

The exotic zebra mussel (*Dreissena polymorpha*) poses a new threat to our native mussels. Zebra mussels were accidentally introduced to this country in 1986 when a ship discharged its ballast water into Lake St. Clair, Michigan. The ballast contained the larvae of the zebra mussel. The zebra mussel is a small freshwater mollusc with zebra like stripes on its shell. Zebra mussels have quickly spread through the nation’s waterways

by hitching a ride on barges. These mussels quickly colonize new areas and reach very high densities. The zebra mussel will attach to any hard surface. As many as 10,000 zebra mussels have been counted attached to a single freshwater mussel. Because zebra mussels reach such high densities, they can quickly smother native mussel beds.

BIOLOGY

Freshwater mussels are soft-bodied animals enclosed in two shells connected by a hinge. These animals live buried in gravel, sand, or mud at the bottom of lakes, ponds, streams, and rivers. The outer surface of their shells may be smooth, wrinkled, or have knobs or pustules and has a horny covering called the periostracum. Coloration of the shells varies from light yellow to black and may include stripes, spots, or other markings. The beaks (or umbos) are the prominent humps found on each shell at the anterior end. The smooth, shiny material lining the inside of the shell is called the nacre. The mussel's soft body consists of a large, muscled foot for locomotion, gills for breathing, and a digestive tract. Two openings, called siphons, are located at the posterior of the body.

All mussels are filter feeders. With its foot buried in the bottom, a mussel draws fresh water carrying oxygen and nutrients through a siphon while deoxygenated water and waste are expelled through another siphon. The mussel's food consists of bacteria, plankton, and detritus.

Freshwater mussels have a complicated reproductive cycle. Males release sperm into the water column. Females draw water containing the sperm into their gills where it fertilizes the eggs stored in specially modified pouches. The fertilized eggs develop into a larval form known as a glochidium. One female may produce hundreds of thousands of glochidia. The glochidia must then complete their development as parasites on the gills or fins of a fish host. Mussels often require a specific type of fish to serve as the host. If the fish host is not present, the mussel cannot reproduce. The glochidia do not harm the host fish.

Mussels have developed some fascinating ways to attract their fish hosts. In some mussels, the edges of the mantle tissue fluttering in the current look like a pair of small fish. This structure acts as a lure to attract a fish host. When the fish nips at the mantle, the mussel closes quickly, squirting a stream of water and glochidia into the fish's mouth. In other mussel species, the glochidia are discharged in a single mass called a conglutinate. The conglutinate will often look like a small worm. When a fish feeds on these conglutinates, some glochidia are released to become attached to the fish's gills. Once a glochidium has attached itself to a fish host, it quickly becomes completely enclosed or encysted. The glochidium may take a few weeks or several months to transform into an adult stage, depending upon the species. Once the glochidium has developed into a juvenile mussel, it drops to the stream bottom.

Mussels reach sexual maturity in 1 to 4 years. Mussels probably have the longest life spans of any of the freshwater invertebrates. Some of the thicker shelled river species of mussels have a life span of 20 to 40 years.

WHY ARE MUSSELS IMPORTANT?

Freshwater mussels are a renewable resource. They serve as an important food source for many aquatic and terrestrial animals. Mussels improve water quality by filtering out contaminants, sediments, and nutrients from our rivers and streams. A single large mussel will filter several gallons of water a day, helping to remove algae, suspended particles, and contaminants. Mussels also function as environmental indicators. They are sensitive to toxic chemicals and serve as an early warning system that alerts us to problems with water quality. Mussels are used in the cultured pearl and jewelry industry. The annual value of mussel shells to the shell industry has been between \$40 and \$50 million a year.

Cumberland Elktoe

Alasmodonta atropurpurea

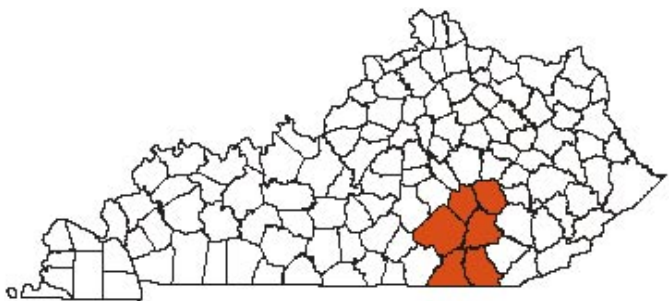
Status: Endangered

Description: The Cumberland elktoe is a thin shelled mussel that grows to about 3.5 inches in length and 1.25 inches in height. The surface of the shell is smooth, shiny and covered with greenish



rays. Young mussels have a yellowish brown shell with adult shells tending to be black. The shape is elliptical. The nacre, or inside of the shell, is shiny with a white, bluish, or salmon color.

Range: The Cumberland elktoe is found in Rock Creek and Marsh Creek in McCreary County.



Habitat: The Cumberland elktoe is found in small creeks and headwater areas. This mussel prefers slow currents in shallow water, inhabiting sand and gravel deposits between large boulders or rubble.

Fanshell

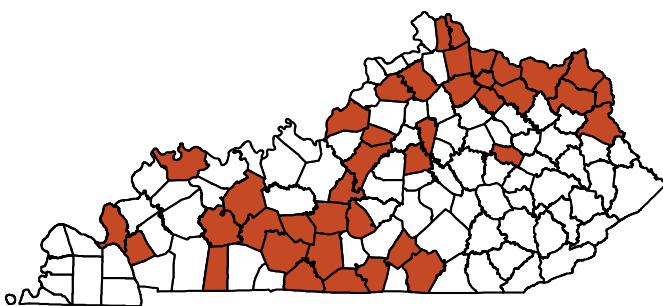
Cyprogenia stegaria

Status: Endangered



Description: The fanshell has a subcircular shell that is rarely more than 3.2 inches in length. Shell color is light green or yellow with green rays. The inside of the shell is silvery white.

Range: The fanshell is found in the Green, Licking, Cumberland, Red, Salt, Ohio and Tennessee Rivers. It has also been found in Tygarts Creek and Drakes Creek.



Habitat: This mussel is found in medium sized to large rivers of the Ohio River basin. The fanshell occurs in coarse sand and gravel substrates and prefers moderate to swift currents.

Cumberlandian Combshell

Epioblasma brevidens

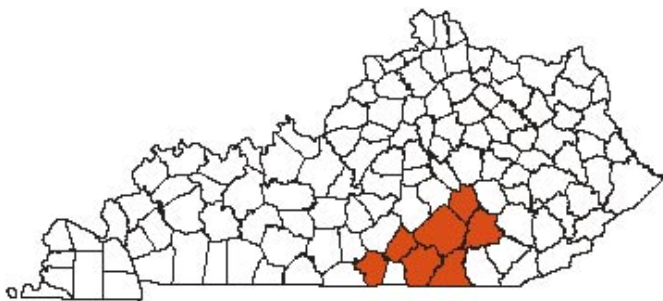
Status: Endangered

Description: The Cumberlandian combshell has a thick solid shell. The outer surface is usually smooth, although it may also be cloth-like in texture. The shell color is yellow to brown, with narrow green rays. The rays are broken. The inside of the shell is white. The shells of females are inflated with serrations along the margin of the shell.



ture. The shell color is yellow to brown, with narrow green rays. The rays are broken. The inside of the shell is white. The shells of females are inflated with serrations along the margin of the shell.

Range: The Cumberlandian combshell is restricted to Buck Creek in Pulaski County, and Big South Fork Cumberland River.



Habitat: The Cumberlandian combshell is a mussel of small to medium sized streams and rivers with gravel bottoms.

Oyster Mussel

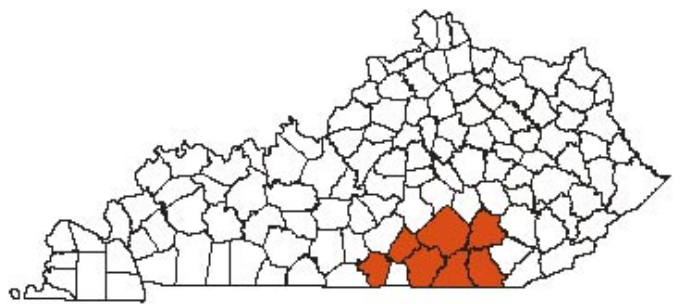
Epioblasma capsaeformis

Status: Endangered

Description: A mussel with a dull yellowish or green colored shell with numerous dark green rays. The inside of the shell is white to bluish white. The shells of females are slightly inflated and are quite thin and expanded toward the shell's posterior margin.



Range: This mussel is found in Buck Creek in Pulaski County, and the Big South Fork Cumberland River.



Habitat: The oyster mussel inhabits small to medium sized streams and rivers with gravel bottoms.

Catspaw

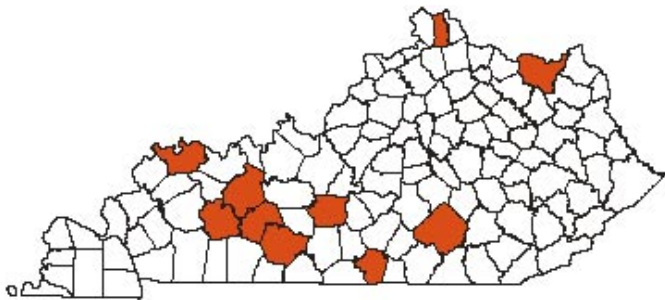
Epioblasma obliquata obliquata

Status: Endangered

Description: A small to medium sized mussel. The shell reaches 3 inches in length and is very solid. The shell color is green to tan. The shell surface is covered with fine, faint, wavy green rays and has a smooth shiny surface. The nacre or inside covering of the shell is purple. The shell shape of the female is rectangular while the male shell is oblong.



Range: The catspaw is found in the Green River.



Habitat: The catspaw inhabits large rivers of the Ohio River basin with coarse gravel bottoms.

Northern Riffleshell

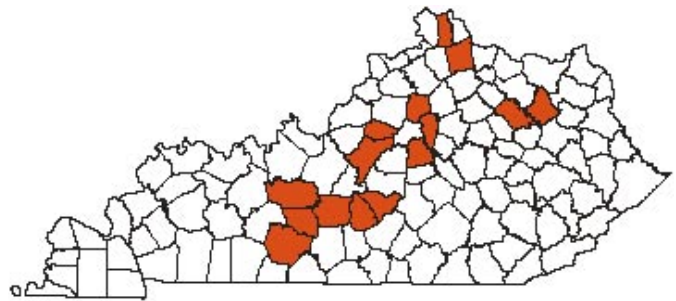
Epioblasma torulosa rangiana

Status: Endangered

Description: A compressed shell that grows to 3 inches. The shell is greenish, yellowish, or tan with fine green wavy lines or rays. The inside of the shell is usually white.



Range: The northern riffleshell is found in the Green River.



Habitat: The northern riffleshell is found in small streams to large rivers. It shows a preference for bottoms of finely packed sand or gravel.

Pink Mucket

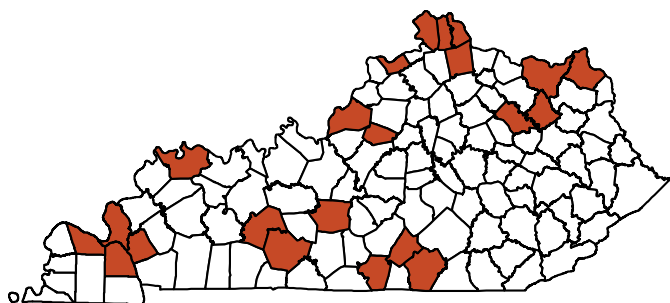
Lampsilis abrupta

Status: Endangered

Description: The shell of the pink mucket is somewhat oval or elliptical in shape. This mussel is 4 inches long and 2.5 inches in height. The surface of the shell is smooth, except for the concentric growth rings. Outer shell color is greenish brown or yellow, with wide green rays in younger mussels. The inside of the shell is pink to solid white.



Range: This mussel inhabits the lower Ohio River, Tennessee River, and upper Green River.



Habitat: The pink mucket is found in medium to large rivers with moderate to fast flowing currents.

Ring Pink

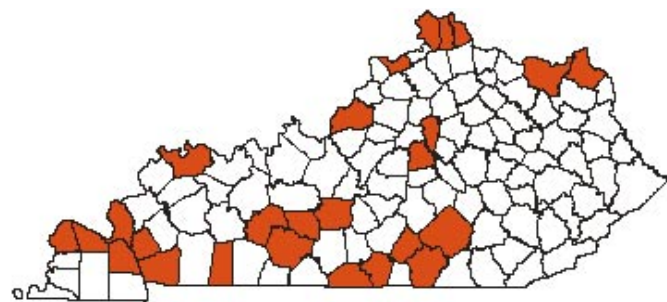
Obovaria retusa

Status: Endangered

Description: A thick, medium sized shell up to 4 inches in length. The shell shape is oval with the shells of males being higher than they are long. The shells of females are more elongate. Shell color is brown to tan. The inside of the shell is purple with a white border.



Range: The ring pink inhabits the Green River.



Habitat: A large river species, the ring pink is found on gravel bars in swift water. It prefers relatively shallow water with a sand or gravel substrate.

Little-Wing Pearlymussel

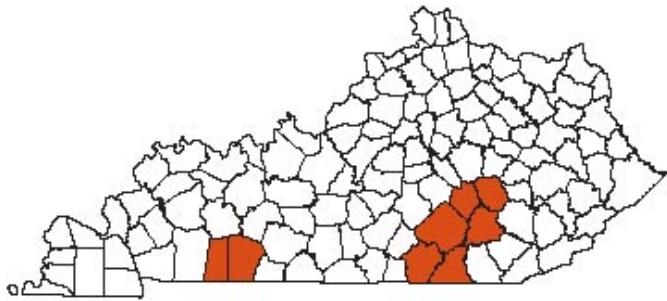
Pegias fabula

Status: Endangered

Description: A small mussel that does not exceed 1.5 inches in length and 0.5 inches in height. The outer surface of the shell is light green or dark yellowish brown with dark rays along the shell's anterior surface. Often the outer surface of the shell (periostracum) is eroded giving the shell a chalky appearance.



Range: The little-wing pearlymussel is found in small to medium sized streams in the Cumberland River basin. It is also an inhabitant of the Red River in Western Kentucky.



Habitat: The little wing pearlymussel is found in small to medium sized streams in the Cumberland River basin. It is found only in cool, clear streams. The little-wing pearlymussel is often found beneath boulders or slab rocks or buried in gravel.

Orange-Foot Pimpleback

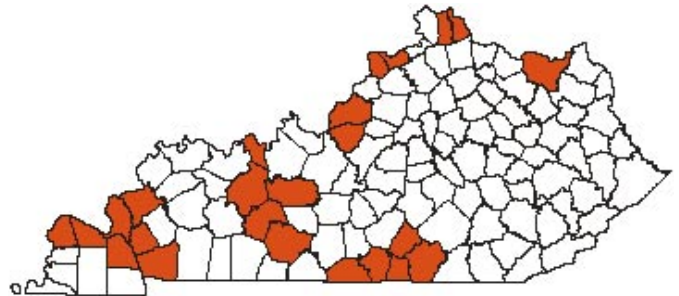
Plethobasus cooperianus

Status: Endangered

Description: The shell of the orange-foot pimpleback is nearly circular to elongate in outline and moderately inflated. The back two-thirds of the surface is covered with numerous raised, prominent knobs. The shell color is dull yellow or yellowish-green, becoming yellowish-brown in older shells. The inside of the shell is silvery-white to light pink, iridescent near the posterior.



Range: An animal of the Ohio River, and lower Tennessee River.



Habitat: The orange-foot pimpleback is a large river species usually found in 15 to 20 feet of water. This species burrows in sand or gravel substrates.

Clubshell

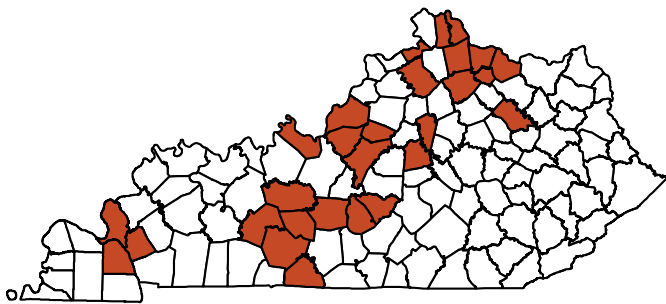
Pleurobema clava

Status: Endangered

Description: This typically small to medium-sized mussel rarely exceeds 3 inches in length. The clubshell has a somewhat triangular shell that is dull yellow or yellowish brown with prominent dark green rays, often interrupted and forming irregular blotches. The inside of the shell is white with the posterior half iridescent.



Range: The clubshell is found in the upper Green and Ohio River.



Habitat: This is a big river species. Clubshells are usually found burrowed 2 to 4 inches below the surface in clean sand or gravel.

Rough Pigtoe

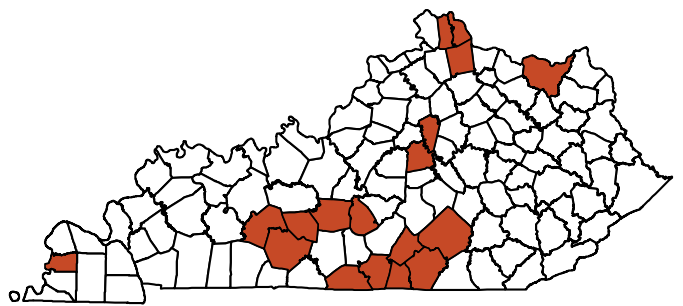
Pleurobema plenum

Status: Endangered

Description: A medium sized mussel with an inflated triangular shaped shell. The shell color ranges from dark brown to yellowish brown. Light green rays may be present on younger specimens. The color of the shell inside varies from pearly white to pink.



Range: This mussel is found in the upper Green River.



Habitat: The rough pigtoe is a large river species. It is found living on gravel bottoms.

Fat Pocketbook

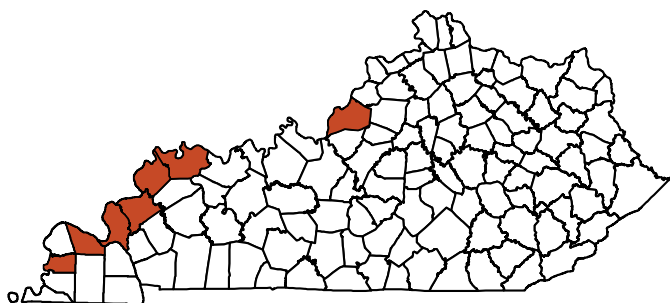
Potamilus capax

Status: Endangered

Description: The shell of the fat pocketbook is greatly inflated, globe-shaped and slightly oblong to circular, with a few faint oblique ridges. Shell color is yellow or yellowish tan. The inside of the shell is silvery or bluish-white, sometimes tinged with salmon, and generally iridescent.



Range: A mussel of the Ohio River, lower Cumberland River, and Mississippi River.



Habitat: A large river species, the fat pocketbook is usually found in backwater areas with muddy or sandy substrates.

Cumberland Bean

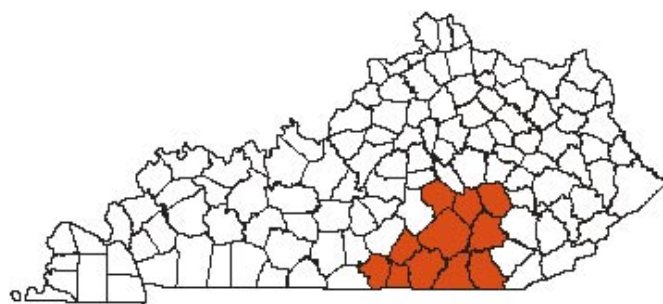
Villosa trabalis

Status: Endangered

Description: A relatively small mussel with an elongated, elliptical shell. The surface of the shell is covered with irregular growth lines. The shell color is dark green, although it may appear almost black with numerous dark green rays on the posterior end. The color inside the shell varies from pearly white to bluish-white.



Range: The Cumberland bean is found in the upper Cumberland River, Buck Creek, Pulaski County, Rockcastle River, Horse Lick Creek, and the Big and Little South Forks of the Cumberland River.



Habitat: This mussel inhabits small to medium streams with gravel bottoms.

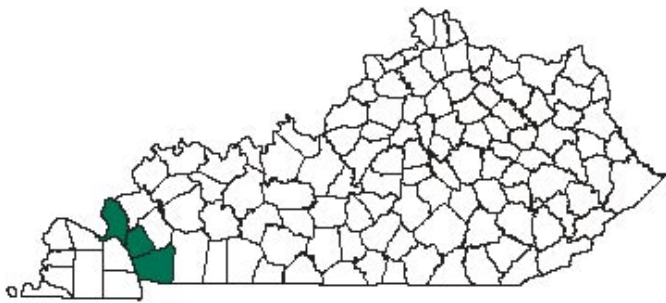
Price's Potato Bean

Apios priceana

Status: Endangered

Description: Price's potato bean is a twining perennial vine in the legume family. Each vine leaf is about 8 to 12 inches with seven leaflets. Leaves are alternately arranged on the stem. The plant's large underground tuber distinguishes it from other *Apios* species and was gathered as a food source by Indians and pioneers. The pink flowers form a large fragrant bloom that grows from the leaf bases, and the fruit is a long slender pod which can be as long as 8 inches.

Range: The range of Price's potato bean is Alabama and Mississippi to Kentucky.



Habitat: Price's potato bean occurs in mesic (moderately moist) forests often next to streams and is usually associated with openings in the forest canopy. Small remnant populations in Kentucky persist on roadsides and powerlines, where light levels are high.

Life History: The large legume flowers of Price's potato bean open in August and are known to be pollinated by honey bees, bumble bees, and long-tailed skippers. Multiple vines can emerge from the large tuber but recruitment of new individuals is by seed establishment.

Causes for Decline: The rarity of Price's potato bean is primarily due to habitat destruction but other impacts such as disease, predation, and historical tuber collection have also contributed. Although the vines can recover from some impacts and may even benefit from some canopy disturbance, intensive



land use such as tree canopy removal and soil bedding may eliminate the plants. Several populations have been protected by management of mowing and herbicide spraying along roadsides. Other management strategies for the protection of Price's potato bean, particularly those in forest habitats, will be pursued to insure the future of this beautiful vine.

Braun's Rock Cress

Arabis perstellata var. *perstellata*

Status: Endangered

Description: This distinctive perennial herb of the mustard plant family is generally about 1 foot in height with lanceolate (narrow) wavy-edged leaves that are alternately arranged on the stem. The white to lavender flowers are four-petaled and formed at the end of the stem. Stellate (star-shaped) hairs on the leaf surface are distinctive for this species. It is named for the botanist that originally described this species, E. Lucy Braun, a distinguished scientist whose early studies of Kentucky's forests are renown.



Range: This plant species is endemic to Kentucky and more specifically to the Kentucky River drainage north of Frankfort.

Habitat: Braun's rock cress is found in steeply sloped, dry to mesic forests on thin calcareous (limestone derived) soils.



Life History: Braun's rock cress first produces a small rosette, a small stemless plant, and then forms an extensive taproot that allows a secure hold among the rocky thin soil. In its third year, a flowering stem is produced and in successive years branches expand. The plants produce abundant seed and, through seedling establishment, have good reproduction potential.

Causes of Decline: Land development for roads, housing and farms, grazing, and other uses has impacted Braun's rock cress. Primary threats are land uses such as heavy grazing or intensive timber harvest that either allow weedy exotic species to invade its habitat or cause the thin soils on these sites to erode.

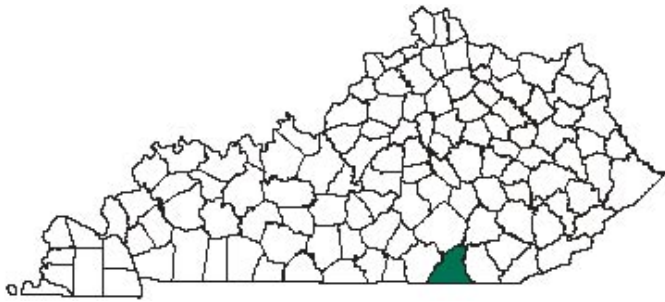
Cumberland Rosemary *Conradina verticillata*

Status: Threatened

Description: Cumberland rosemary is an ever-green member of the mint family. Although not a true rosemary, its foliage is highly aromatic. It is a low-growing shrub with small, blunt, needlelike leaves that are dark green with a pale underside. Leaves are attached to the stem in an opposite arrangement. Most plants are less than a foot tall. The conspicuous flowers are lavender and clustered toward the end of the stems.



Range: Cumberland rosemary is limited to the Cumberland Plateau, and within this region, it occurs only in extreme southern Kentucky and north-east Tennessee.



Habitat: Cumberland rosemary is found on boulder rock bars and low gravel bars along free-flowing rivers and large streams. Plants occur in open sandy deposits in the interior of these annually flooded bars among the large boulders and gravel.

Life History: Plants are highly clonal and primarily reproduce by rooting branches. This species is thought to disperse through fragmentation of pieces of stem that are washed to other river bars. This type of reproduction has resulted in populations with very few individuals, since many plants are clones that have separated from the mother plant. Abundant flowers are produced in May and early June. Seed formation is poor, possibly due to inadequate genetic diversity.

Causes for Decline: The present distribution of cumberland rosemary is very limited, and although its original extent is unknown, the species may have been more common in the past. The impoundment of river flow and coal mining has impacted the flora and fauna in this area and could have eliminated the plants from other parts of the Cumberland River. The most apparent threats to cumberland rosemary in Kentucky are stream impoundment, recreational activities, and disruptive land use that impact the river ecosystem.

Eggert's Sunflower *Helianthus eggertii*

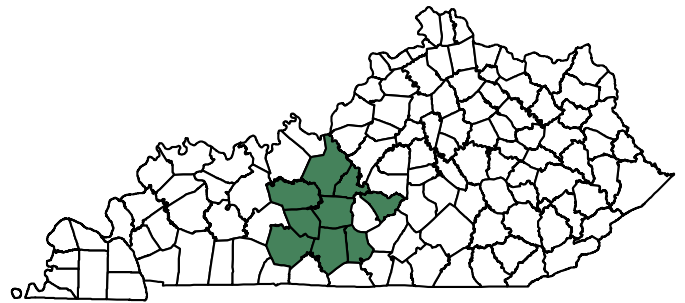
Status: Threatened

Description: Eggert's sunflower is a perennial plant that stands usually 3.5-6.5 feet tall. It has



sessile (stemless) leaves oppositely arranged on the stem. Both the underside of the leaves and the stem have a white coloration. The flower heads are yellow and about 1 inch across.

Range: The range of Eggert's sunflower is central Kentucky and Tennessee, and northcentral Alabama.



Habitat: Eggert's sunflower occurs in barrens/ woodland ecosystems. These ecosystems are a mix of grassy treeless openings among a thin overstory of small to medium sized trees, usually oaks. They have an almost continuous grassy ground cover of species that have affinities to prairies. A combination of drought, periodic fire, and grazing maintain these communities. Eggert's sunflower is also found on roadsides and even in fields where

barrens formerly existed and favorable conditions have persisted.

Life History: The yellow flower heads of Eggert's sunflower open in August and September and are thought to be pollinated by bees. This species primarily establishes at a site by extending rhizomes, or underground stems, that eventually produce large clones of many plants. There is evidence that burning stimulates both vegetative growth and reproduction.

Causes for Decline: Barrens and woodland communities are inherently vulnerable to development because they are not valued as timber lands and are relatively open. Also, natural fire cycles have been disrupted, and as fire frequencies diminish, woody species increase and eventually barren species are eliminated. Eggert's sunflower has declined as its habitat has diminished range wide.

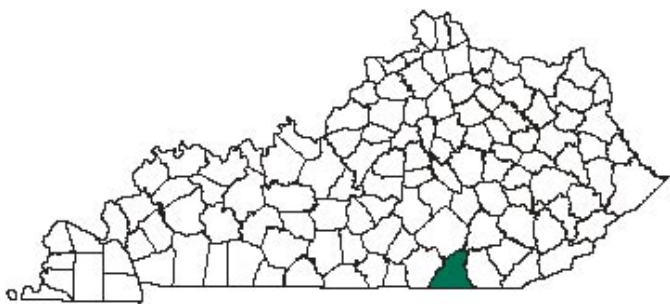
Cumberland Sandwort

Minuartia cumberlandensis

Status: Endangered

Description: Cumberland sandwort is a perennial herb that is diminutive, about 4 to 6 inches tall, and delicate with wiry angular stems. The flowers are small (about 0.25 inches wide) and white. Its leaves are wider and thicker than related species and attached to the stem in an opposite arrangement. Plants are conspicuously leafy at the base of the plant.

Range: As indicative of the name of this species, its range is the Cumberland Plateau in extreme southern Kentucky and northern Tennessee.



Habitat: Cumberland sandwort occurs in moist sandy deposits on sandstone cliff ledges and in shady areas of rockhouses, cave-like areas of undercut rock along a cliff line.

Life History: Unlike other members of its genus, cumberland sandwort prefers moist conditions in humid rockhouses and cliff ledges. Its flowering period is also unique, late June to early July.

Causes of Decline: Rockhouses within the range of cumberland sandwort have been impacted by recreational use (mostly hiking and camping), archaeological digging, and other significant changes in the surrounding forest such as logging. Populations of this species are small, as are the rockhouse areas where they occur. These circumstances make the cumberland sandwort especially vulnerable to impacts that result in changes to the environment such as humidity or light levels, as well as natural ecological fluctuations.

White-haired Goldenrod

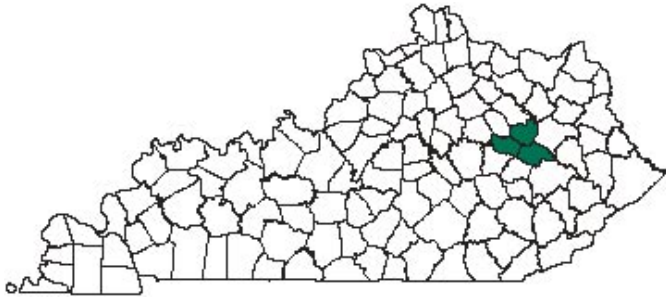
Solidago albopilosa

Status: Endangered

Description: White-haired goldenrod is an herbaceous perennial plant in the sunflower family. This species derives its name from the white hairs densely covering the leaves and stems, a feature that distinguishes it from most other common goldenrods. Stem growth is zigzag in form, and although the stems are usually 1 to 2 feet long, the plants are typically laxly spreading. Leaves are green on the

surface with a pale underside and are alternately arranged on the stem. Clusters of fragrant yellow flowers are born at the base of the leaves.

Range: White-haired goldenrod is endemic to east-central Kentucky in the Red River Gorge.



Habitat: This plant is found in sandstone rock-houses (cave-like areas of undercut rock along a cliff line), or on rock ledges.

Life History: White-haired goldenrod is insect pollinated. Flowering occurs from September through November, and fruit mature from October to December.

Causes of Decline: Considering the localized range of white-haired goldenrod, it is possible that this species was always endemic to the Red River Gorge. It is also suggested that this species could be a relic plant that was once more widespread and has found refuge in the unique geology of this area. The primary threat to the species is the recreational impacts of hikers, rockclimbers, and campers. Archaeological looting has also destroyed or



impacted some populations. Erosion on upper cliffs and intensive forestry practices can also degrade the habitat for this species.

Short's Goldenrod

Solidago shortii

Status: Endangered

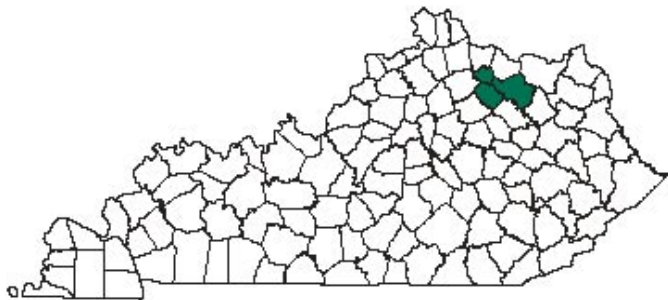
Description: Short's goldenrod, a member of the sunflower family, is a perennial plant generally about 2 feet tall with alternately arranged leaves. It is distinguished from other common goldenrods by its completely glabrous (hairless) and tri-nerved



leaves and by having the longest leaves at the middle of the stem. It forms a bright yellow bloom August through October.

Range: Short's goldenrod is endemic to the Blue Licks area of northcentral Kentucky, an area encompassing the juncture of Robertson, Nicholas, and Fleming counties. Historically, the plant was

known from Rock Island in the Ohio River near Louisville; the island was later submerged by dam construction.



Habitat: Short's goldenrod is found at the edges or in openings of oak and hickory forest and is associated with thin limestone soils.

Life History: The occurrence of Short's goldenrod in the Blue Licks area is linked to the area's historic use as a gathering site for migrating bison. These herds were attracted to the mineral springs, and their annual visits created a cycle of disturbance in this landscape. It is believed that this goldenrod adapted to these conditions and grew in the denuded areas created by the bison.

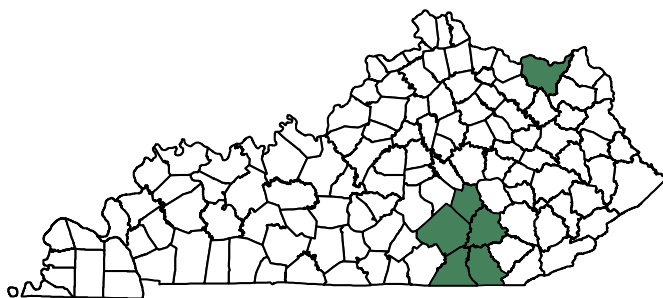
Plants begin growth in spring and reach full size by August. The plants have a spreading rhizome that forms multiple emergent stems. Flowers are insect pollinated and produce seeds in the fall.

Causes of Decline: It is possible that this plant was associated with bison movement and became rare as the bison disappeared. The plant may never have been common, but the gap in its range between the Ohio River and Blue Licks suggests it was once more widespread. Land use changes including the disruption of natural forest cycles and the use of fescue and other pasture grasses have caused the decline of this species.



reminiscent of related cultivated species. These shrubs are clonal and produce an extensive underground rhizome. Stem growth is variable, including high arching canes and straight wand-like forms. This variability is probably related to population age. Leaves are arranged alternately on the stem.

Range: Virginia spiraea is known from Virginia to eastern Kentucky and Tennessee.



Habitat: This plant is found in stream banks and gravel bars along free-flowing streams.

Life History: The extensive underground root system of Virginia spiraea helps to stabilize stream banks and sand bars. The species withstands annual flooding in these stream corridors. It relies on vegetative reproduction to spread since it rarely produces seed.

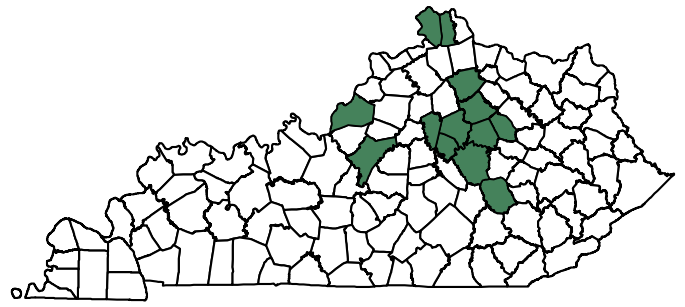
Virginia Spiraea

Spiraea virginiana

Status: Threatened

Description: Virginia spiraea is a woody shrub in the rose family. The delicate white blooms that form on this native spiraea in early summer are

Causes of Decline: Impacts resulting from impoundment and erosion have dramatically altered stream banks, and the quality of the habitat for Virginia spiraea continues to decline. Other changes in the landscape have also been discussed in explaining the rarity of this species. It has even been suggested that Virginia spiraea may have been more common in glacial ages. The wide distribution of the species suggests that it has been more common in the past. Protection efforts for this beautiful shrub will focus on reducing degradation to stream corridors and the effects of land use on the adjacent uplands.



Running Buffalo Clover

Trifolium stoloniferum

Status: Endangered

Description: Running buffalo clover is a member of the pea family. This perennial clover forms long runners from its base and lacks pubescence (hair) that is found on many nonnative clovers. Typical for clovers, the species has three rounded leaflets. In



this species, these leaflets are nearly as wide as long and are usually a light green. Most distinctive for this species is a pair of leaves on the flower stalk. The flowers are white and about 0.5 inches long.

Range: Running buffalo clover occurs in West Virginia, Kentucky, Ohio, Indiana, and Missouri. In Kentucky, it occurs primarily in the Bluegrass Region.

Habitat: Habitats vary for this species, ranging from stream banks and low moist forests to successional areas in mesic forests. What all these different habitats have in common is moderate periodic disturbance such as light grazing or animal trails. Running buffalo clover also has been found at sites such as cemeteries and lawns, that have been historically maintained only by occasional mowing. This is a disturbance regime that mimics the natural conditions for this species.

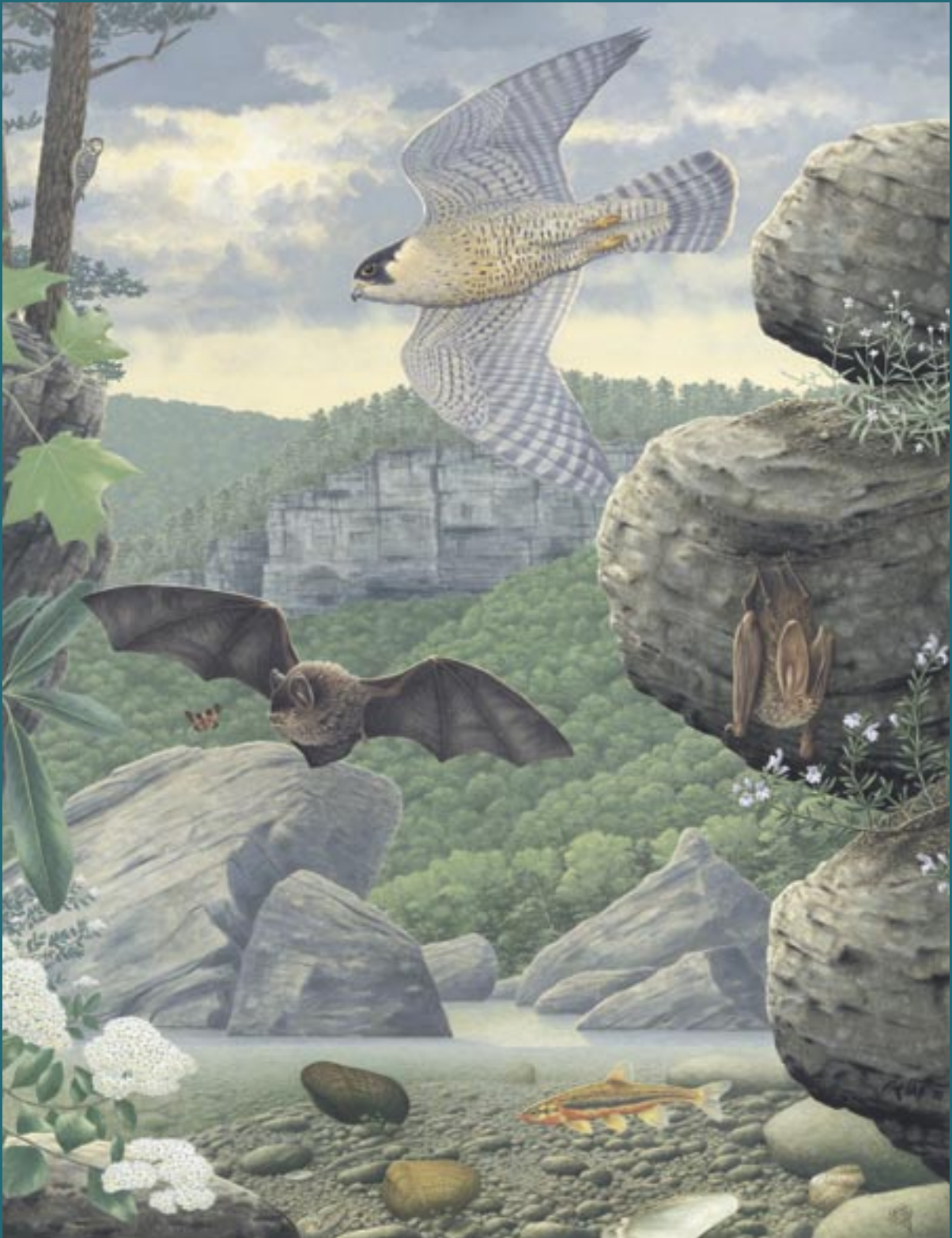
Life History: Running buffalo clover is one of only two species of clover native to Kentucky. The other species, also a buffalo clover, occurs in the western part of the state and is also rare. It is believed that both were named for their association with bison activity. The formation of runners or stolons allows running buffalo clover to spread and separate to form new plants. Flowering occurs in April and May, with fruit maturing mostly in midsummer.

Causes for Decline: Running buffalo clover is thought to have been more common prior to the waves of new settlers into Kentucky in the 1800s. Historical accounts of the abundance of clover during early settlement indicate that it was formerly more widespread, especially in the Bluegrass region. Although there is still mystery surrounding the rapid decline of running buffalo clover, changes in the landscape resulting from settlement and the elimination of large herbivores (bison and deer) is likely the primary cause. Habitat loss as well as the introduction and increase in exotic weed species, particularly other clovers, has also contributed.

PHOTO CREDITS

Virginia big-eared bat	John MacGregor, Daniel Boone National Forest
Gray bat	John MacGregor, Daniel Boone National Forest
Indiana bat	John MacGregor, Daniel Boone National Forest
Bald eagle	Adam Jones
Red-cockaded woodpecker	Todd Engstrom, Cornell Laboratory of Ornithology
Interior least tern	Uve Hublitz, Cornell Laboratory of Ornithology
Peregrine falcon	Adam Jones
Copperbelly water snake	John MacGregor, Daniel Boone National Forest
Relict darter	Pat Ceas, Eastern Kentucky University
Duskytail darter	David Eisenhour, Morehead State University
Palezone shiner	Larry Page
Blackside dace	Photo courtesy of Southern Illinois University at Carbondale
Pallid sturgeon	Dr. David Eisenhour, Morehead State University
American burying beetle	Larry Master, The Nature Conservancy
Kentucky cave shrimp	John MacGregor, Daniel Boone National Forest
Cumberland elktoe	G. Thomas Watters, Ohio State University, Museum of Biological Diversity
Fanshell	G. Thomas Watters, OSU, Museum of Biological Diversity
Cumberlandian combshell	G. Thomas Watters, OSU, Museum of Biological Diversity
Oyster mussel	G. Thomas Watters, OSU, Museum of Biological Diversity
Catspaw	G. Thomas Watters, OSU, Museum of Biological Diversity
Northern riffleshell	G. Thomas Watters, OSU, Museum of Biological Diversity
Pink mucket	G. Thomas Watters, OSU, Museum of Biological Diversity
Ring pink	G. Thomas Watters, OSU, Museum of Biological Diversity
Little-wing pearlymussel	G. Thomas Watters, OSU, Museum of Biological Diversity
Orange-foot pimpleback	John Williams, Eastern Kentucky University
Clubshell	G. Thomas Watters, OSU, Museum of Biological Diversity
Rough pigtoe	G. Thomas Watters, OSU, Museum of Biological Diversity
Fat pocketbook	G. Thomas Watters, OSU, Museum of Biological Diversity
Cumberland bean	G. Thomas Watters, OSU, Museum of Biological Diversity
Price's potato-bean	KSNPC Staff Photo
Braun's rock cress	John MacGregor, Daniel Boone National Forest
Cumberland rosemary	Marc Evans, Kentucky State Nature Preserves Commission
Eggert's sunflower	KSNPC Staff Photo
Cumberland sandwort	Eugene Wofford, University of Tennessee
White-haired goldenrod	KSNPC Staff Photo
Short's goldenrod	Marc Evans, Kentucky State Nature Preserves Commission
Virginia spiraea	Doug Ogle, Virginia Highlands College
Running buffalo clover	Tom Bloom, Kentucky State Nature Preserves Commission

*Introducing
“Species on the Edge”*



“Species on the Edge” is a poster featuring 11 threatened and endangered species, found in the Cumberland Plateau region of Kentucky. It is available from the Kentucky Department of Fish and Wildlife Resources by calling 1-800-858-1549. The 22"x 34" poster is an original artwork by Rick Hill, whose work also appears on the cover of this book.

Save Something on your Taxes



Check “Nature and Wildlife Fund” on Your Kentucky Income Tax Return.

Kentucky Department of Fish and Wildlife Resources
#1 Game Farm Road
Frankfort, KY 40601
502 564-4336



Kentucky State Nature Preserves Commission
801 Schenkel Lane
Frankfort, KY 40601
502 573-2886



A portion of your checkoff dollars help us manage endangered species.